CLAIMS

1. A method for detecting and measuring aberrations in an optical system comprising:

providing a test target with at least one open figure including a multiple component array of phase zones, wherein the multiple phase zones are arranged within the open figure so that their responses to lens aberrations are interrelated and the phase zones respond uniquely to specific aberrations depending on their location within the figure;

placing the test target in an object plane of a projection system;

imaging a photoresist film with the projection system; and

comparing the image in the photoresist film to a reference image without aberrations to detect aberrations in the optical system.

2. The method of claim 1 wherein the differences between the imaged photoresist and the reference image indicate the type and degree of aberration.

3. The method of claim 1 wherein the optical system comprises microelectronic photolithographic equipment for exposing a semiconductor wafer to a photomask carrying a pattern for a microelectroic device.

4. The method of claim 1 wherein size of the phase zones and the spaces between the phase zones are between $0.5\lambda/NA$ to $1.5\lambda/NA$ where λ is the wavelenght of the light exposing the target and NA is the numerical aperture of the exposure system.

5. The method of claim 1 wherein the size of the target is between $2.0\lambda/NA$ to $6.0\lambda/NA$ where λ is the wavelenght of the light exposing the target and NA is the numerical aperture of the exposure system.

6. The method of claim 1 wherein the phase zones are 180 degrees out of phase with respect to the rest of the target.

7. The method of claim 1 wherein the phase zones are etched into the surface of the target.

8. The method of claim 1 wherein the phase zones comprise at least two zones with one phase zone larger than the other phase zone.

9. The method of claim 1 wherein the phase zones comprise at least two zones of substantially the same size.

10. The method of claim 1 wherein the phase zones comprise a central phase zone and plurality of circumferential phase zones wherein the central phase zone is larger than the circumferential phase zones.

11. The method of claim 1 wherein the phase zones comprise a central phase zone and plurality of circumferential phase zones wherein the central phase zone is substantially the same size as the circumferential phase zones.

12. The method of claim 1 wherein the phase zones comprise a central phase zone and plurality of circumferential phase zones wherein the central phase zone is smaller than the circumferential phase zones.

13. The method of claim 1 wherein each phase zone is circular, rectangular, elliptical, or hexagonal.

14. The method of claim 1 wherein the target comprises a central phase zone and eight circumferential phase zones equally angularly spaced from each other for detecting astigmatism, coma, spherical aberration and three point aberration.

15. The method of claim 1 wherein the test target has at least two circumferential phase zones spaced 180 degrees apart from each other for detecting positive or negative lens aberation.

16. The method of claim 15 wherein the test target has at least two more circumferential phase zones spaced 180 apart from each other and 90 degrees from the first two circumferential phase zones for detecting positive and negative lens aberation.

17. The method of claim 15 wherein the test target has at least four circumferential phase zones located at 0, 90, 180, 270 dgreees and two more phase zones at 135 and 315 degrees or 45 and 225 degrees to detect 45 degree astigmatism.

18. The method of claim 15 wherein the test target has phase zones with similar or different shapes.

19. The method of claim 1 wherein the test target has phase zones with circular, rectangular, elliptical, petagonal, triangular or hexagonal sphapes.

20. The method of claim 1 wherein the test target has phase zones with the same shape.

21. The method of claim 1 wherein the test target has a central phase zone with one shape and circumferential phase zones with a different shape.

22. A method of detecting aberrations of an optical imaging system, comprising the steps of :

arranging a test object in the object plane of the system;

providing a photoresist layer in the image plane of the system;

imaging the test object by means of the system and an imaging beam;

developing the photoresist layer, and

detecting the developed image by means of a scanning detection device having a resolution which is considerably larger than that of the imaging system,

characterized in that use is made of a test object which comprises at least one open figure having a phase structure, wherein the image of this figure is compared to a reference image of known or no abberation in order to determine the type and amount of aberration in the optical imaging system.

23. A test target comprising at least one open figure including a multiple component array of phase zones, wherein the multiple zones are arranged within the open figure so that their responses to lens aberrations are interrelated and the zones respond uniquely to specific aberrations depending on their location within the figure.

24. The test target of claim 23 wherein the multiple component array of phase zones comprises a central phase zone and a plurality of circumferential phase zones.

25. The test target of claim 23 wherein there are at lest two phase zones and one is larger than the other.

26. The test target of claim 23 wherein the circumferential phase zones features are disposed at equal radial locations from the central phase zone and and are equally angularly spaced from each other.

27. The test target of claim 23 wherein there are at least eight circumferential phase zones.

28. The test target of claim 27 wherein the eight cirumferential phase zones are located at 0, 45, 90, 135, 180, 225, 270, and 315 degrees with respect to the central phase zone.

29. The test target of claim 23 having at least two circumferential phase zones spaced 180 degrees apart from each other for detecting positive or neagative astigmatism.

30. The test target of claim 29 having at least two more circumferential phase zones spaced 180 apart from each other and 90 degrees from the first two circumfertial phase zones for deteting positive and negative astigmatism.

31. The test target of claim 23 having at least four circumferential phase zones located at 0, 90, 180, 270 dgreees and two more phase zones at 135 and 315 degrees or 45 and 225 degrees to detect 45 degree astigmatism.

32.. The test target of claim 31 wherein the phase zones have the same or different shapes.

33. The test target of claim 31 wherein the phase zones have circular or rectangular sphapes.

34. The test target of claim 31 wherein the phase zones have the same shape.

35. The test target of claim 31 wherein the central phase zone has one shape and the circumferential phase zones have a different shape.

36. The test target of claim 23 wherein the size of the phase zones and the spaces between the phase zones are between 0.5λ/NA to 1.5λ/NA where λ is the wavelenght of the light exposing the target and NA is the numerical aperture of the exposure system.

37. The test target of claim 23 wherein the size of the target is between 2.5λ/NA to 5.0λ/NA where λ is the wavelenght of the light exposing the target and NA is the numerical aperture of the exposure system.

38. The test target of claim 23 wherein the phase zones are 180 degrees out of phase with respect to the rest of the target.

39. The test target of claim 23 wherein the phase zones are etched into the surface of the target.